



February 2008



## FGL40N120AND 1200V NPT IGBT

### Features

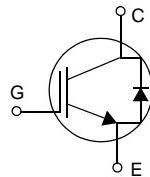
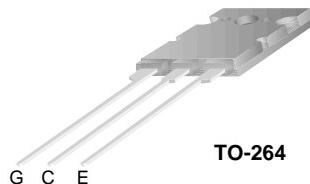
- High speed switching
- Low saturation voltage :  $V_{CE(sat)} = 2.6 \text{ V}$  @  $I_C = 40\text{A}$
- High input impedance
- CO-PAK, IGBT with FRD :  $t_{rr} = 75\text{ns}$  (typ.)

### Applications

Induction Heating, UPS, AC & DC motor controls and general purpose inverters.

### Description

Employing NPT technology, Fairchild's AND series of IGBTs provides low conduction and switching losses. The AND series offers a solution for application such as induction heating (IH), motor control, general purpose inverters and uninterruptible power supplies (UPS).



### Absolute Maximum Ratings

Symbol	Parameter	FGL40N120AND	Units
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 25$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	64	A
	Collector Current @ $T_C = 100^\circ\text{C}$	40	A
$I_{CM(1)}$	Pulsed Collector Current	160	A
$I_F$	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	40	A
$I_{FM}$	Diode Maximum Forward Current	240	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	500	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	200	W
$SCWT$	Short Circuit Withstand Time, $V_{CE} = 600\text{V}$ , $V_{GE} = 15\text{V}$ , $T_C = 125^\circ\text{C}$	10	$\mu\text{s}$
$T_J$	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temp. for Soldering Purposes, 1/8" from Case for 5 seconds	300	$^\circ\text{C}$

#### Notes:

(1) Pulse width limited by max. junction temperature

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction-to-Case	--	0.25	$^\circ\text{C/W}$
$R_{\theta JC}(\text{DIODE})$	Thermal Resistance, Junction-to-Case	--	0.7	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	25	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGL40N120AND	FGL40N120AND	TO-264	-	-	25

## Electrical Characteristics of the IGBT $T_C = 25^\circ\text{C}$ unless otherwise noted

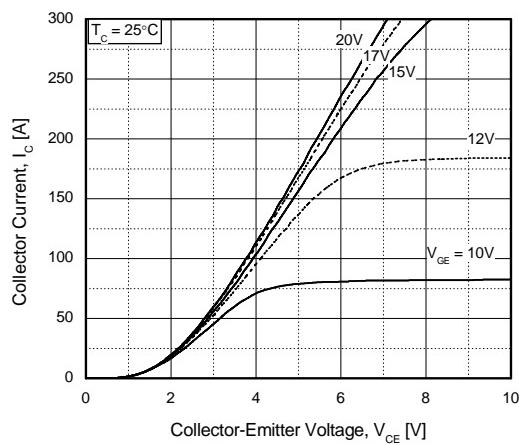
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0\text{V}, I_C = 1\text{mA}$	1200	--	--	V
$BV_{CES}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{V}, I_C = 1\text{mA}$	--	0.6	--	$\text{V}/^\circ\text{C}$
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{V}$	--	--	1	mA
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{V}$	--	--	$\pm 250$	nA
<b>On Characteristics</b>						
$V_{GE(\text{th})}$	G-E Threshold Voltage	$I_C = 250\mu\text{A}, V_{CE} = V_{GE}$	3.5	5.5	7.5	V
		$I_C = 40\text{A}, V_{GE} = 15\text{V}$	--	2.6	3.2	V
$V_{CE(\text{sat})}$	Collector to Emitter Saturation Voltage	$I_C = 40\text{A}, V_{GE} = 15\text{V}, T_C = 125^\circ\text{C}$	--	2.9	--	V
		$I_C = 64\text{A}, V_{GE} = 15\text{V}$	--	3.15	--	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance		--	3200	--	pF
$C_{oes}$	Output Capacitance	$V_{CE} = 30\text{V}, V_{GE} = 0\text{V}$ $f = 1\text{MHz}$	--	370	--	pF
$C_{res}$	Reverse Transfer Capacitance		--	125	--	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time		--	15	--	ns
$t_r$	Rise Time		--	20	--	ns
$t_{d(off)}$	Turn-Off Delay Time	$V_{CC} = 600\text{V}, I_C = 40\text{A}, R_G = 5\Omega, V_{GE} = 15\text{V},$ Inductive Load, $T_C = 25^\circ\text{C}$	--	110	--	ns
$t_f$	Fall Time		--	40	80	ns
$E_{on}$	Turn-On Switching Loss		--	2.3	3.45	mJ
$E_{off}$	Turn-Off Switching Loss		--	1.1	1.65	mJ
$E_{ts}$	Total Switching Loss		--	3.4	5.1	mJ
$t_{d(on)}$	Turn-On Delay Time		--	20	--	ns
$t_r$	Rise Time		--	25	--	ns
$t_{d(off)}$	Turn-Off Delay Time	$V_{CC} = 600\text{V}, I_C = 40\text{A}, R_G = 5\Omega, V_{GE} = 15\text{V},$ Inductive Load, $T_C = 125^\circ\text{C}$	--	120	--	ns
$t_f$	Fall Time		--	45	--	ns
$E_{on}$	Turn-On Switching Loss		--	2.5	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	1.8	--	mJ
$E_{ts}$	Total Switching Loss		--	4.3	--	mJ
$Q_g$	Total Gate charge		--	220	330	nC
$Q_{ge}$	Gate-Emitter Charge	$V_{CE} = 600\text{V}, I_C = 40\text{A}, V_{GE} = 15\text{V}$	--	25	38	nC
$Q_{gc}$	Gate-Collector Charge		--	130	195	nC

**Electrical Characteristics of DIODE**  $T_C = 25^\circ\text{C}$  unless otherwise noted

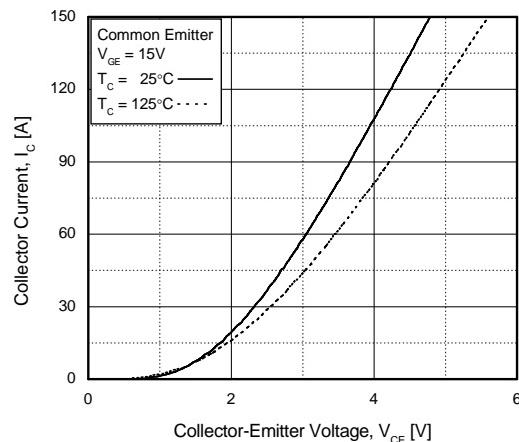
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units	
$V_{FM}$	Diode Forward Voltage	$I_F = 40\text{A}$	$T_C = 25^\circ\text{C}$	--	3.2	4.0	V	
			$T_C = 125^\circ\text{C}$	--	2.7	--		
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 40\text{A},$ $di/dt = 200\text{A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	--	75	112	nS	
			$T_C = 125^\circ\text{C}$	--	130	--		
	Diode Peak Reverse Recovery Current		$T_C = 25^\circ\text{C}$	--	8	12	A	
			$T_C = 125^\circ\text{C}$	--	13	--		
$Q_{rr}$	Diode Reverse Recovery Charge	$T_C = 25^\circ\text{C}$	--	300	450	--	nC	
			$T_C = 125^\circ\text{C}$	--	845	--		

## Typical Performance Characteristics

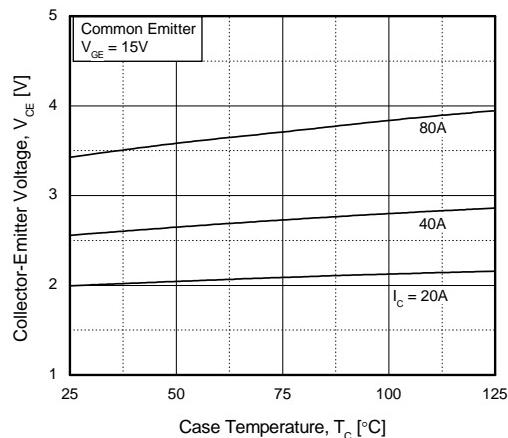
**Figure 1. Typical Output Characteristics**



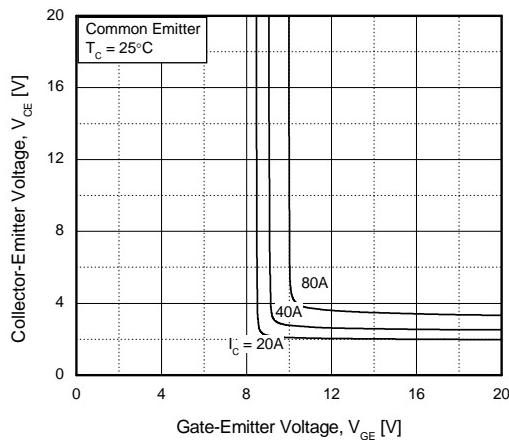
**Figure 2. Typical Saturation Voltage Characteristics**



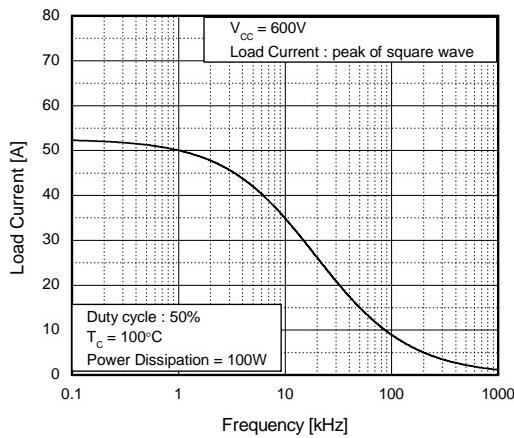
**Figure 3. Saturation Voltage vs. Case Temperature at Variant Current Level**



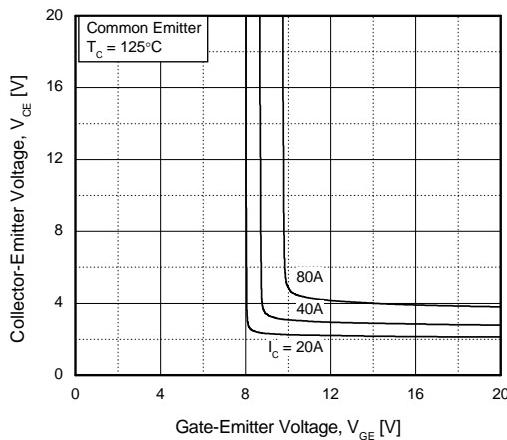
**Figure 5. Saturation Voltage vs.  $V_{GE}$**



**Figure 4. Load Current vs. Frequency**



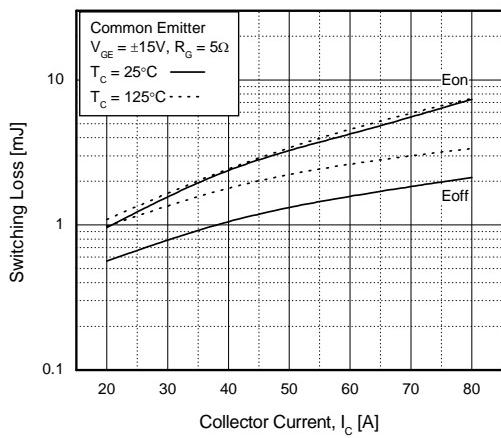
**Figure 6. Saturation Voltage vs.  $V_{GE}$**



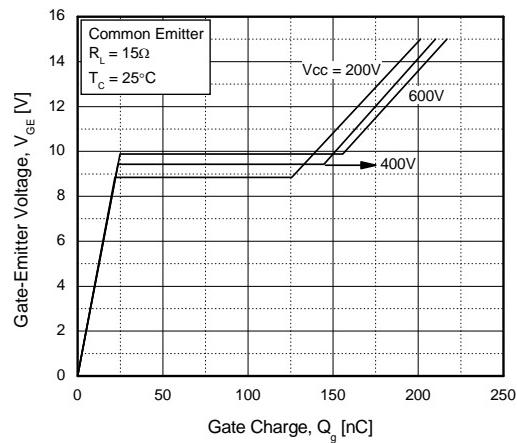


## Typical Performance Characteristics (Continued)

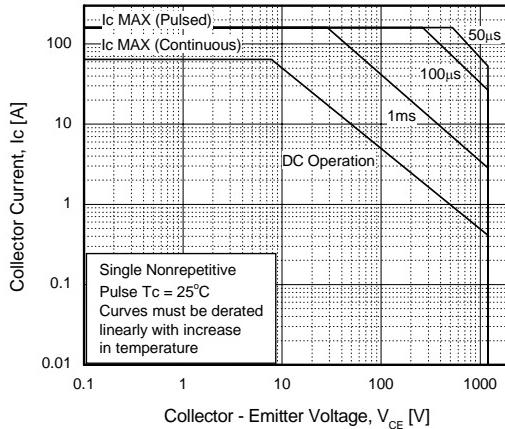
**Figure 13. Switching Loss vs. Collector Current**



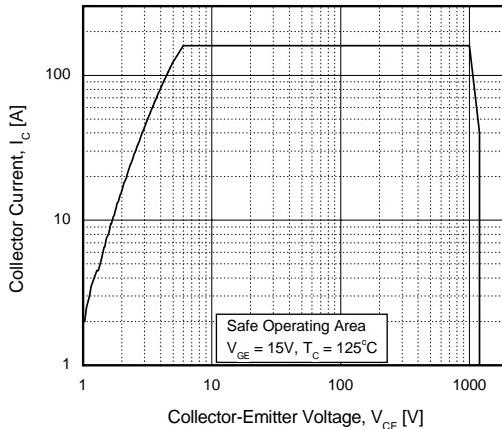
**Figure 14. Gate Charge Characteristics**



**Figure 15. SOA Characteristics**



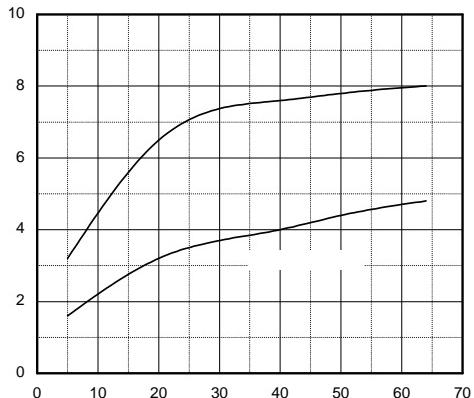
**Figure 16. Turn-Off SOA**



**Figure 17. Forward Characteristics**

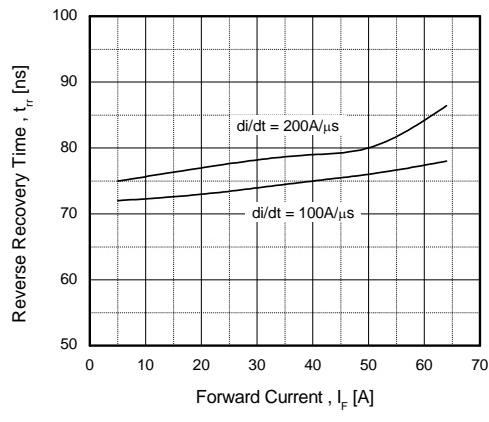


**Figure 18. Reverse Recovery Current**

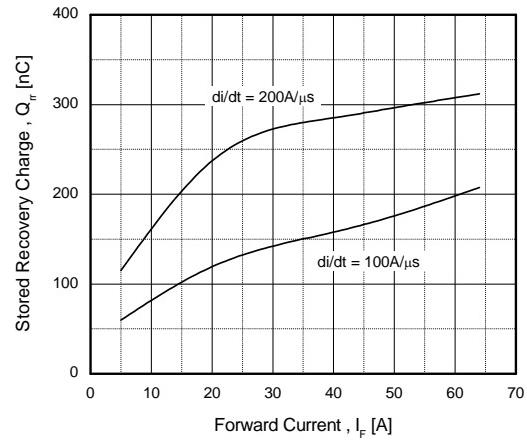


## Typical Performance Characteristics (Continued)

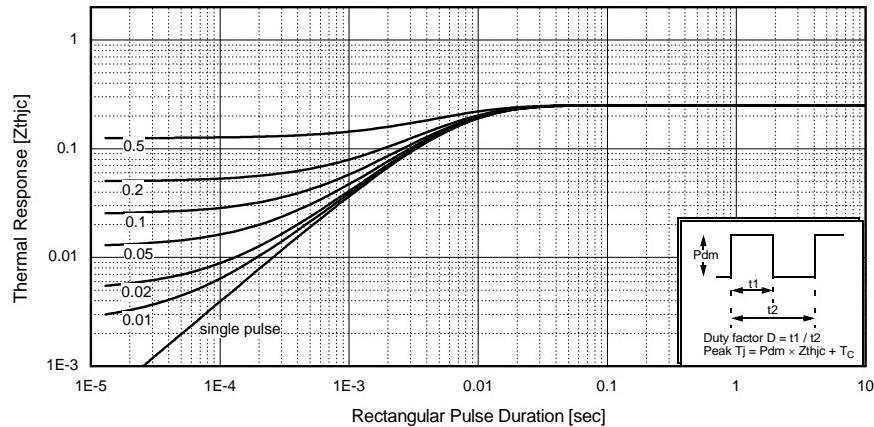
**Figure 19. Stored Charge**



**Figure 20. Reverse Recovery Time**



**Figure 21. Transient Thermal Impedance of IGBT**



**Mechanical D**

**FGL40N120AND**



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